Forest Biomass Sustainability and Carbon Policy Study Overview

Prepared for: Commonwealth of Massachusetts Department of Energy Resources

Prepared by: Manomet Center for Conservation Sciences

Plymouth, Massachusetts

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Study Team

- Manomet
  - **John S. Gunn, Ph.D., Senior Program Leader**
- Forest Guild
  - **Bob Perschel, Director Northeast Region**
  - Zander Evans, PhD, Research Director
- Pinchot Institute for Conservation
  - Brian Kittler, Project Director
- Biomass Energy Resource Center
  - **Chris Recchia, Executive Director**
  - Andrea Colnes, Policy and Development Director
- Independent Consultants
  - **Thomas Walker, Natural Resource Economist**
  - **Peter Cardellichio, PhD, Forest Economist**
  - David Saah, PhD, Principal, Spatial Informatics Group
  - Anne Perschel, Psy.D., President, Germane Consulting

Focus of the Study

1. How much wood is available from forests to support biomass energy development in Massachusetts?
2. What are the atmospheric greenhouse gas implications of shifting energy production from fossil fuel sources to forest biomass?
3. What are the potential ecological impacts of increased biomass harvests on forests in the Commonwealth, and what if any policies are needed to ensure these harvests are sustainable?

What Was Not the Focus of the Study

1. The study did not analyze the impacts of non-GHG pollutants emitted from energy generation facilities (e.g., particulate matter, NOx, SO_2, or other air pollutants such as mercury).
2. We did not evaluate the supply or GHG dynamics of non-forest woody feedstocks (e.g., C&D, mill residue, landscape & yard waste).
3. Transportation issues, water use, economic benefits—all important but not part of what DOER asked us to do.

Overview

- Forest Biomass Supply
- Forest Sustainability and Biomass Harvesting
- Forest Biomass and Atmospheric GHG Accounting
- Study Team Available to Answer Questions

Forest Biomass Supply

- New supplies of *economically available* forest biomass for energy generation in Massachusetts depend heavily on the prices that bioenergy facilities can pay.
- Economic availability reflects the costs of harvesting, processing and transporting this material as well as our expectations about landowner decisions to harvest.
- Not much “logging residue” available, so our estimates and models also include unmerchantable and low quality trees.

Forest Biomass Supply

- Under current policies total "new" forest biomass from forest lands in MA would be between 150,000 and 250,000 green tons/year —increasing by 50%–100% when out-of-state forest biomass sources are included.
- At high price ($20 per green ton), supplies of forest biomass from in-state and out-of-state sources could be 1.2 to 1.5 million green tons/year.
- Does not include land clearing or non-forest sources such as tree work and landscaping.

Forest Sustainability and Biomass Harvests

- Options Available to Promote Sustainability at Site Scale
  - Adopt harvesting guidelines that ensure

(1) enough coarse woody debris is left on the ground, particularly at nutrient poor sites, to ensure continued soil productivity and

(2) enough standing dead wildlife trees remain to protect biodiversity.

- *Forest Guild Biomass Retention and Harvesting Guidelines for the Northeast* is offered as a guide to establish a set of harvesting guidelines for northeastern forest types.
- In general, when 1/3 of the basal area is being removed on a 15 to 20 year cycle, retain 1/4 to 1/3 of the slash, tops, and limbs from harvest. (varied with intensity of harvest)

Forest Sustainability and Biomass Harvests

- Options Available to Promote Sustainability at Landscape Scale
  - Establish a transparent self-monitoring, self-reporting process for bioenergy facilities designed to foster sustainable wood procurement practices.
  - Require bioenergy facilities to purchase wood from forests with approved forest management plans.
  - Require bioenergy facilities to submit wood supply impact assessments.
  - Establish formal criteria for approval of wood supply impact assessments.

Forest Biomass and Atmospheric GHG Carbon Accounting

- ‘Debt-then-Dividend’ Framework: Compare a ‘Business as Usual’ (BAU) Baseline with Biomass Energy Scenario.

  - BAU assumes continued emissions from fossil fuels and continued sequestration in the unharvested landscape and forests harvested for timber but not biomass energy.

  - Biomass Energy scenario assumes GHG emissions & sequestration from:
    - energy generation,
    - unharvested forested landscape sequestration,
    - BAU forest management
    - plus additional biomass removals (logging residues and cull, unmerchantable trees).

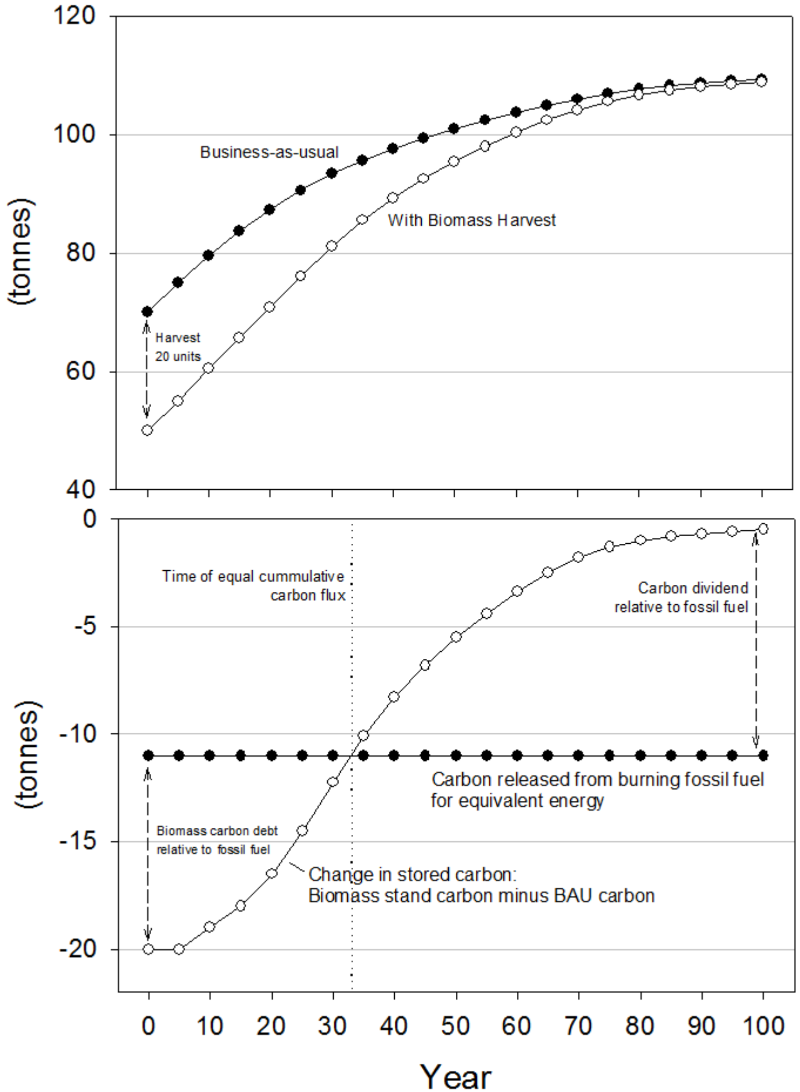
Forest Biomass and Atmospheric GHG Carbon Accounting

- What matters in this calculation?
  - *Biomass Source* (1): Is it material that would have entered the atmosphere relatively quickly in the absence of a biomass energy opportunity?
  - *Lifecycle GHG Emissions*: What are the emissions from the biomass energy technology (2) and how do these compare with those from the fossil alternative (3)?
  - *Forest Management* (4): How do carbon levels in the forest change over time with and without biomass harvests?

Biomass Carbon Modeling Framework

Figure 2: Carbon Debt Summary Table

Excess Biomass Emissions as % of Total Biomass Emissions				
Scenarios	Coal	Oil (#6)	Oil (#2)	Natural Gas
Electric	31%			66%
Thermal/ CHP		2%-8%	9%-15%	33%-37%



Debt and Dividend Insights

- Using wood for energy generally emits more GHGs (per unit of energy generated) initially than fossil fuels, these emissions are removed from the atmosphere as harvested forests re-grow.
- Different sources of woody biomass have different GHG profiles (e.g., tops and limbs, or tops and limbs & low-grade).
- Biomass technology and fossil fuel replacement choices affect carbon recovery timing.
- Forest management choices by landowners can either accelerate or decelerate carbon recovery.
- Forest emissions baselines will be different – Maine is not Massachusetts.

Cumulative Debt and Dividend

- Debt from annual harvesting and annual emissions from energy generation accumulates over time and across the landscape.

- Recovery of harvested stands also accumulates over time and across the landscape.

Cumulative Carbon Recovery Summary Emissions from Multiple Years

Cumulative Carbon Dividends: 2010 to 2050

Harvest	Fossil Fuel Technology			
Scenario	Oil (#6), Thermal	Coal, Electric	Gas, Thermal	Gas, Electric
1	22%	-3%	-13%	-110%
2	34%	11%	3%	-80%
3	8%	-22%	-34%	-148%
4	15%	-13%	-24%	-129%
5	16%	-11%	-22%	-126%
6	7%	-25%	-36%	-153%

Cumulative Carbon Dividends: 2010 to 2100

Harvest	Fossil Fuel Technology			
Scenario	Oil (#6), Thermal	Coal, Electric	Gas, Thermal	Gas, Electric
1	40%	19%	12%	-63%
2	56%	42%	36%	-18%
3	31%	8%	0%	-86%
4	43%	24%	17%	-54%
5	37%	16%	9%	-69%
6	31%	8%	-1%	-86%

- The full study presents results from varied scenarios and is intended to provide insight into the range of potential changes to the forest and atmospheric GHG and the associated uncertainties.